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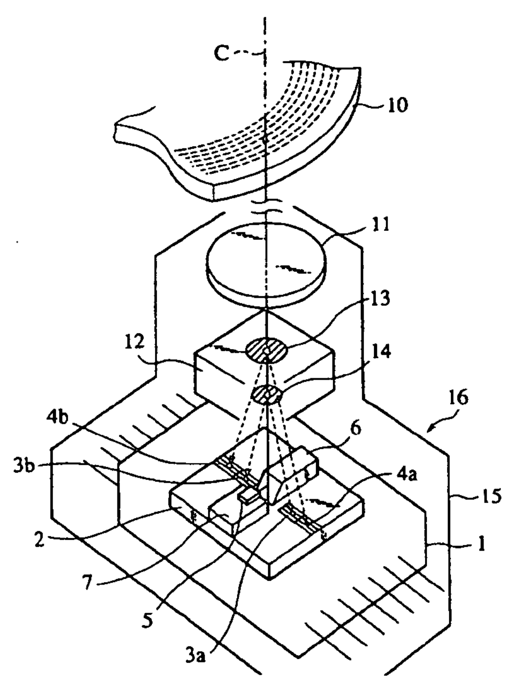
(54) Optical pickup and optical device

(57) An optical pickup of this invention includes a first laser beam source (8) having a wave length of 780 nm and a second laser beam source (9) having a second wave length of 650 nm wherein the first laser beam source (8) and the second laser beam source (9) are disposed in the vicinity of each other, emission lights from the first laser beam source (8) and the second laser beam source (9) are emitted along substantially the same optical axis and a reflected light from the information recording medium (10) is returned along the optical axis; the first diffraction grating (13), the second diffraction grating (14) and the light receiving device substrate (2) are disposed in order, the first diffraction grating (13) is substantially transparent for a wave length of 780 nm and diffracts a wave length of 650 nm, and the second diffraction grating (14) is substantially transparent for a wave length of 650 nm while it diffracts a wave length of 780 nm.

FIG.3



ing device substrate 50 and a first hologram device 52 are integrally fixed in a casing(package) and an optical device 71 in which a second laser beam source 57, a second light receiving device substrate 56 and a second hologram 58 are integrally fixed in a casing(package) can be constructed in a compact configuration each, this example cannot make it possible to combine these optical devices to produce a compact single optical device.

[0010] In case for producing an optical device for the latter conventional optical pickup, although as shown in Fig.2, an optical device 73 in which a first laser beam source 60 and a second laser beam source 61 are fixed in a casing(package) can be constructed, this example cannot make it possible to combine the first and second laser beam sources 60, 61, light receiving device substrate 65 and the like to produce a compact single optical device.

SUMMARY OF THE INVENTION

[0011] Accordingly, the present invention is achieved to solve the above problems, and therefore it is an object of the invention to provide an optical pickup and optical device in which light usability in a process from a laser beam source up to a light receiving device substrate hardly deteriorates unlike a conventional example and which can be constructed in a compact configuration.

[0012] To achieve the above object, according to a first aspect of the present invention, there is provided an optical pickup for irradiating light to an information recording medium and reading information by using a reflected light from the information recording medium, the optical pickup comprising: a first laser beam source having a first wave length; a second laser beam source having a second wave length; a first diffraction grating; a second diffraction grating provided on a face different from a face on which the first diffraction grating is provided; and a light receiving device substrate having a plurality of light receiving regions on the same plane, wherein the first laser beam source and the second laser beam source are disposed in the vicinity of each other, emission lights from the first laser beam source and the second laser beam source are emitted to the information recording medium along substantially the same optical axis and a reflected light from the information recording medium is returned along the optical axis; the first diffraction grating, the second diffraction grating and the light receiving device substrate are disposed in order substantially perpendicular to the optical axis; the first diffraction grating is substantially transparent for any one of the first wave length and the second wave length and diffracts the other wave length; and the second diffraction grating is substantially transparent for the other wave length while it diffracts the one wave length.

[0013] According to the present invention, a light emitted from the first laser beam source having a first wave length is diffracted by the second diffraction grating and this 0-order (0th-order) diffracted light is substantially transmitted through the first diffraction grating and then introduced toward the information recording medium. A reflected light from the information recording medium substantially is transmitted through the first diffraction grating and this light is diffracted by the second diffraction grating. Then, the ± primary-order diffracted light is irradiated to the light receiving device substrate. A light emitted from the second laser beam source having a second wave length passes through the second diffraction grating and this passing light is diffracted by the first diffraction grating. The 0-order (0th-order) diffracted light is introduced toward the information recording medium and a reflected light from the information recording medium is diffracted by the first diffraction grating. The ± primary-order diffracted light substantially is transmitted through the second diffraction grating and is irradiated to the light receiving device substrate. Thus, when a light having the first wave length and a light having the second wave length substantially pass through any one of the first and second diffraction gratings, they substantially are transmitted therethrough, and only when they pass through the other, they are diffracted. Consequently, light usability in a process from the first and second laser beam sources up to the light receiving device substrate is substantially the same as that of a conventional example. Further, because it is so constructed that the first laser beam source and second laser beam source are disposed in the vicinity of each other, emission lights from the first laser beam source and second laser beam source are emitted to the information recording medium along substantially the same optical axis and the reflected lights are returned along substantially the same optical axis as above-mentioned optical axis, the first laser beam source/second laser beam source and the light receiving device substrate can be disposed in the vicinity of each other, so that a compact optical pickup can be constructed.

[0014] To achieve the above object, according to a second aspect of the present invention, there is provided an optical pickup for irradiating light to an information recording medium and reading information by using a reflected light from the information recording medium, the optical pickup comprising: a first laser beam source having a first wave length and a linearly polarized light; a second laser beam source having a second wave length and a linearly polarized light substantially perpendicular to the polarized light of the first laser beam source; a first diffraction grating; a second diffraction grating provided on a face different from a face on which the first diffraction grating is provided; and a light receiving device substrate having a plurality of light receiving regions on the same plane, wherein the first laser beam source and the second laser beam source are disposed in the vicinity of each other, emission lights from the first laser beam source and the second laser beam source are emitted to the information recording medium along

length plate and further is transmitted through the first diffraction grating and this light is diffracted by the second diffraction grating and its ± primary-order diffracted light is irradiated to the light receiving device substrate. A light emitted from the second laser beam source, having the second wave length and a linearly polarized light substantially the same as that of the first laser beam source passes through the second diffraction grating. This transmitting light is transmitted through the first diffraction grating and is provided with a phase difference of 1/4 wave length . The light whose phase is changed is introduced toward the recording medium. A reflected light from the information recording medium is further provided with a phase difference of 1/4 wave length by the wave length plate so as to be changed to a linearly polarized light perpendicular to that of the incident light. This light is diffracted by the first diffraction grating in a polarized state and its ± primary-order diffracted light substantially is transmitted through the second diffraction grating and then is irradiated to the light receiving device substrate. Consequently, when an emission light from any one of the first laser beam source and the second laser beam source passes through any one of the first and second diffraction gratings, they substantially are transmitted therethrough, and only when they pass through the other, they are diffracted. Consequently, light usability in a process from any one of the first and second laser beam sources up to the light receiving device substrate is substantially the same as an conventional example. Further, when an emission light from the other one of the first laser beam source and second laser beam source is introduced to the information recording medium, it substantially is transmitted through both the first and second diffraction gratings. Then, the light is diffracted by one of the first and second diffraction gratings first after it is reflected by the information recording medium to return to the light receiving device substrate. Consequently, light usability in a process from the other one of the first and second laser beam sources up to the light receiving device substrate is far more excellent than a conventional example. Further, because it is so constructed that the first laser beam source and second laser beam source are disposed in the vicinity of each other, emission lights from the first laser beam source and second laser beam source are emitted to the information recording medium along substantially the same optical axis and the reflected lights are returned along substantially the same optical axis as the former optical axis, the first laser beam source/second laser beam source and the light receiving device substrate can be disposed in the vicinity of each other, so that a compact optical pickup can be constructed.

[0018] To achieve the above object, according to a fourth aspect of the present invention, there is provided an optical device for use in the optical pickup described in the first aspect wherein the first laser beam source, the second laser beam source, the first diffraction grating, the second diffraction grating and the light receiving device substrate are integrally fixed in the same casing.

[0019] The optical device according to the fourth aspect of the invention is capable of obtaining the same effect as the optical pickup described in the first aspect. To achieve the above object, according to a fifth aspect of the present invention, there is provided an optical device for use in the optical pickup described in the second aspect wherein the first laser beam source, the second laser beam source, the first diffraction grating, the second diffraction grating and the light receiving device substrate are integrally fixed in the same casing.

[0020] The optical pickup according to the fifth aspect of the invention is capable of obtaining the same effect as the optical pickup described in the second aspect.

[0021] To achieve the above object, according to a sixth aspect of the present invention, there is provided an optical device for use in the optical pickup described in the third aspect wherein the first laser beam source, the second laser beam source, the wave length plate, the first diffraction grating, the second diffraction grating and the light receiving device substrate are integrally fixed in the same casing.

[0022] The optical device according to the sixth aspect of the present invention is capable of obtaining the same effect as the optical pickup of the second aspect.

[0023] The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings.

[0024] BRIEF DESCRIPTION OF THE DRAWINGS

[0025] In the accompanying drawings:

Fig.1 is a schematic structure drawing of a conventional optical pickup;

Fig.2 is a schematic structure drawing of other conventional optical pickup;

Fig.3 is a schematic perspective view of an optical pickup according to a first embodiment of the present invention;

Figs.4A, 4B are diagrams showing irradiation positions on a light receiving device substrate of emission beams from first and second laser beam sources;

Figs.5A, 5B are diagrams showing diffraction and transmission at first and second diffraction gratings of the emission beams of the first and second laser beam sources in the first embodiment of the present invention;

Fig.6 is a characteristic diagram showing depth dependency of a diffraction grating in case where wave length is 795 nm and 659 nm;

Fig.7 is a characteristic diagram showing total efficiency (reciprocation efficiency of 0-order diffracted beam, and 0-order diffracted beam X ± primary-order diffracted beam) of depth dependency of dif-

tracking error detection and the like in a playback unit using a wavelength of 780 nm.

[0035] The objective lens 11, transparent sheet-like member 12, laser beam source device 5, light receiving device substrate 2 and wiring substrate 1 are fixed integrally to the same casing(package) 15. That is, this optical device 16 of an optical system of the optical pickup can be constructed so as to excel in compact integration.

[0036] Next, an operation of the above-described structure will be described. If beam having the wave length of 780 nm and beam having the wave length of 650 nm are emitted from the first laser beam source 8 and second laser beam source 9. the emitted incident lights are reflected by the micro mirror 6 so as to be incident light to the disc 10 having the optical axis C in the vertical direction. The incident light along the optical axis C is subjected to diffraction/transmission which will be described below, by the second diffraction grating 14 and first diffraction grating 13, passes through the transparent sheet-like member 12, is converged by the objective lens 11 and then irradiated to the disc 10 as a converged light. The reflected light from the disc 10 goes along the aforementioned optical axis C like the incident light and is introduced to the objective lens 11 and transparent sheet-like member 12. This light is subjected to diffraction/transmission by the first diffraction grating 13 and second diffraction grating 14, passes through the transparent sheet-like member 12 and then is irradiated to the light receiving device substrate 2.

[0037] The diffraction/transmission of the first and second diffraction gratings 13, 14 will be described with reference to Figs.5A, 5B. As shown in Fig.5A, an incident light from the first laser beam source 8 is a light having the wave length of 780 nm and this incident light is subjected to diffraction by the diffraction grating 14, so that the 0-order transmission light is transmitted substantially all through the first diffraction grating 13 and irradiated to the disc 10. A reflected light from the disc 10 is transmitted substantially all through the first diffraction grating 13 and this transmitted light is subjected to diffraction/branching by the second diffraction grating 14. The ± primary-order diffracted light by this diffraction is irradiated to a pair of the inner light receiving regions 3a, 3b of the light receiving device substrate 2.

[0038] As shown in Fig.5B, an incident light from the second laser beam source 9 is a beam having the wave length of 650 nm. This incident light is transmitted substantially all through the second diffraction grating 14 and this transmitted light is subjected to diffraction by the first diffraction grating, so that the 0-order (0th-order) transmitted light is irradiated to the disc 10. A reflected light from the disc 10 is subjected to diffraction/branching by the first diffraction grating 13. The ± primary-order diffracted light by diffraction is transmitted substantially all through the second diffraction grating 14 and irradiated to a pair of the outer light receiving regions 4a, 4b of the light receiving device substrate 2.

[0039] That is, a light having the wave length of 780 nm substantially is transmitted through the first diffraction grating 13 and only when it passes through the second diffraction grating 14, it is subjected to diffraction. A light having the wave length of 650 nm substantially is transmitted through the second diffraction grating 14 and only when it passes through the first diffraction grating 13, it is subjected to diffraction. Thus, light usability of each wave length between the first/second laser beam sources 8, 9 and the light receiving device substrate 2 is substantially the same as conventionally.

[0040] Because it is so constructed that the first laser beam source 8 and the second laser beam source 9 are disposed adjacent to each other, emission lights from the first laser beam source 8 and the second laser beam source 9 are emitted to the disc 10 along substantially the same optical axis C and the reflected lights return along the same optical axis C, the first laser beam source 8/second laser beam source 9 and the light receiving device substrate 2 can be disposed in the vicinity of each other so that a compact optical pickup can be constructed. For the same reason, the optical system of the optical pickup can be constructed as a single optical device 16.

[0041] Fig.6 is a characteristic diagram showing depth dependency of the diffraction grating in case where the wave length is 795 nm and 659 nm. By changing the depth of the diffraction grating, diffraction efficiency changes periodically. Although this is slightly different from the wave length used in the first embodiment, it is considered that there exists a similar depth dependency of the diffraction grating between the wave lengths of 780 nm and 650 nm.

[0042] Referring to Fig.6, in case where the depth of the diffraction grating is near 1400 nm, the efficiency of the 0-order (0th-order) diffracted light of 659 nm light is substantially 1.0, that is, this light substantially is transmitted through. As for 795 nm light, the efficiency of the ± primary-order diffracted light is substantially 0.2. In case where the depth of the diffraction grating is near 1700 nm, the efficiency of the 0-order diffracted light of the 795 nm light is substantially 1.0, that is, this light substantially is transmitted through. As for the 659 nm light, the efficiency of the ± primary-order diffracted light is substantially 0.3. Wave length selectivity can be provided depending on the depth of the diffraction grating.

[0043] Fig.7 is a characteristic diagram showing total efficiency of depth dependency of the diffraction grating in case where the wave length is 795 nm and 659 nm. Because light passes through the first and second diffraction gratings 13, 14 twice in both the directions and further, the diffracted light for use is 0-order diffracted light and ± primary-order diffracted light, the depth of the diffraction grating needs to be set up so that a reciprocation efficiency expressed by a product of the 0-order diffracted light and ± primary-order diffracted light is high. Referring to Fig.7, in case where the depth

the first laser beam source 8 and the second laser beam source 9 are disposed adjacent to each other, emission lights from the first laser beam source 8 and the second laser beam source 9 are emitted to the disc 10 as an information recording medium along substantially the same optical axis C and the reflected light is returned substantially along the aforementioned optical axis, the first laser beam source 8/second laser beam source 9 and the light receiving device substrate 2 can be disposed in the vicinity of each other, so that a compact optical pickup can be formed. For the same reason, the optical system of the optical pickup can be formed so as to excel in compact integration.

[0054] Although according to the second embodiment, the first diffraction grating 13 is provided with polarization dependency and the second diffraction grating 14 is provided with wave length dependency, it is permissible to so construct them inversely. That is, like the first embodiment, it is permissible to provide the first diffraction grating 13 with the wave length selectivity by only the depth of unevenness of the surface, so that a light having the wave length of 780 nm is diffracted and a light having the wave length of 650 nm is substantially transmitted through, and provide the second diffraction grating 14 with polarization dependency by forming the optically anisotropic material member according to the region selectivity refractive change so that a linearly polarized light of TE mode is substantially transmitted through and the linearly polarized light of TM mode is diffracted.

[0055] Figs. 9A, 9B show a third embodiment of the present invention. Fig. 9A is a diagram showing diffraction and transmission of an emission light from the first laser beam source at the first and second diffraction gratings 13, 14. Fig. 9B is a diagram showing diffraction and transmission of an emission light from the second laser beam source at the first and second diffraction gratings 13, 14. In the third embodiment, a description of the same components as the first embodiment is omitted, but only a different structure will be described.

[0056] That is, the first laser beam source 8 has the wave length of 780 nm and emits linearly polarized light of TE mode. The second laser beam source 9 has the wave length of 635 nm and emits a linearly polarized light of TE mode which is polarized in the same direction as the first laser beam source 8.

[0057] A wave length plate 21 and an optically anisotropic material member 20 are disposed at the same position as the transparent sheet-like member 12 of the first embodiment. As shown in Figs. 9A, 9B, the wave length plate 21 has wave length dependency, so that a light having the wave length of 780 nm is substantially transmitted through and a light having the wave length of 650 nm is deflected by 1/4 wave length. The wave length plate 21 is disposed substantially perpendicular to the aforementioned optical axis C.

[0058] A first diffraction grating 13 is formed on a top face of the optically anisotropic material member 20 and a second diffraction grating 14 is formed on a bottom face thereof. Because the first diffraction grating 13 and the second diffraction grating 14 are the same as the second embodiment, a description thereof is omitted.

[0059] The objective lens, wave length plate 21, optically anisotropic material member 20, laser beam source device 5, light receiving device substrate 2 and wiring substrate 1, these components constituting an optical system of the optical pickup, are fixed to the same casing(package) integrally. That is, they are constructed as an optical device for constituting the optical system of the optical pickup.

[0060] Next, an operation of the above structure will be described. The optical path of light emitted from the first and second laser beam sources 8, 9 is the same as the first embodiment and different therefrom in an operation of the invention when light passes through the optically anisotropic material member 20 and wave length plate 21 on two ways. That is, referring to Fig.9A, a beam having a wave length of 780 nm and a linearly polarized light of TE mode, emitted from the first laser beam source is diffracted by the second diffraction grating 14 and the 0-order diffracted light is substantially transmitted through the first diffraction grating 13 and further the wave length plate 21, so that it is introduced to the disc 10 as an information recording medium. A reflected light from the disc 10 is substantially transmitted through both the wave length plate 21 and the diffraction grating 13 and this light is diffracted by the second diffraction grating 14, so that this ± primary-order diffracted light is irradiated to the light receiving device substrate 2.

[0061] Referring to Fig.9B, a beam having the wave length of 650 nm and a linearly polarized light of TE mode, emitted from the second laser beam source 9 is transmitted through the second diffraction grating 14 and the first diffraction grating 13, and this transmitted light is provided with a phase difference of 1/4 wave length by the wave length plate 21 so as to be changed to a circularly polarized light of right turn. The circularly polarized light of right turn is introduced to the disc 10. Because the reflected light from the disc 10 is inverted in phase by reflection, this is changed to a circularly polarized light of left turn. The circularly polarized light of left turn is provided with a phase difference by 1/4 wave length by the wave length plate 21 so as to be changed to a linearly polarized light of TM mode based on semiconductor laser. Because this TM mode linearly polarized light impinges upon the first diffraction grating 13, it is subjected to diffraction, so that the ± primary-order diffracted light is substantially transmitted through the second diffraction grating 14 and irradiated to the light receiving device substrate 2.

[0062] Thus, an emission light from the first laser beam source 8 is substantially transmitted through the first diffraction grating 13 when it passes therethrough, while that light is subjected to diffraction when it passes

different members separately and then bond them together by positioning. This method has an advantage that this device can be produced with a simple production machine.

[0073] More generally, it should be understood that many modifications and adaptations of the invention will become apparent to those skilled in the art and it is intended to encompass such obvious modifications and changes in the scope of the claims appended hereto.

Claims

1. An optical pickup for irradiating light to an information recording medium (10) and reading information by using a reflected light from the information recording medium (10), the optical pickup comprising:

   a first laser beam source (8) having a first wave length;
   a second laser beam source (9) having a second wave length;
   a first diffraction grating (13);
   a second diffraction grating (14) provided on a face different from a face on which the first diffraction grating (13) is provided; and
   a light receiving device substrate (2) having a plurality of light receiving regions (3a, 3b, 4a,4b) on the same plane,
   wherein the first laser beam source (8) and the second laser beam source (9) are disposed in the vicinity of each other, emission lights from the first laser beam source (8) and the second laser beam source (9) are emitted to the information recording medium (10) along substantially the same optical axis and a reflected light from the information recording medium (10) is returned along the optical axis;
   the first diffraction grating (13), the second diffraction grating (14) and the light receiving device substrate (2) are disposed in order substantially perpendicular to the optical axis;
   the first diffraction grating (13) is substantially transparent for any one of the first wave length and the second wave length and diffracts the other wave length; and
   the second diffraction grating (14) is substantially transparent for the other wave length while it diffracts the one wave length.

2. An optical pickup for irradiating light to an information recording medium (10) and reading information by using a reflected light from the information recording medium (10), the optical pickup comprising:

   a first laser beam source (8) having a first wave length and a linearly polarized light;
   a second laser beam source (9) having a second wave length and a linearly polarized light substantially perpendicular to the polarized light of the first laser beam source (8);
   a first diffraction grating (13);
   a second diffraction grating (14) provided on a face different from a face on which the first diffraction grating (13) is provided; and
   a light receiving device substrate (2) having a plurality of light receiving regions (3a, 3b, 4a, 4b) on the same plane,
   wherein the first laser beam source (8) and the second laser beam source (9) are disposed in the vicinity of each other, emission lights from the first laser beam source (8) and the second laser beam source (9) are emitted to the information recording medium (10) along substantially the same optical axis and a reflected light from the information recording medium (10) is returned along the optical axis;
   the first diffraction grating (13), the second diffraction grating (14) and the light receiving device substrate (2) are disposed in order substantially perpendicular to the optical axis;
   any one of the first diffraction grating (13) and the second diffraction grating (14) is substantially transparent for a linearly polarized light of any one of the first laser beam source (8) and the second laser beam source (9) and diffracts the other linearly polarized light; and
   the other one of the first diffraction grating (13) and the second diffraction grating (14) is substantially transparent for a wave length possessed by a laser beam source whose laser beam is diffracted by the first diffraction grating (13), of the first and second laser beam sources (8, 9), and diffracts a wave length possessed by a laser beam source whose laser beam substantially is transmitted through the first diffraction grating (13), of the first and second laser beam sources (8, 9).

3. An optical pickup for irradiating light to an information recording medium (10) and reading information by using a reflected light from the information recording medium (10), the optical pickup comprising:

   a first laser beam source (8) having a first wave length and a linearly polarized light;
   a second laser beam source (9) having a second wave length and a linearly polarized light substantially the same as the first laser beam source (8);
   a wave length plate (21);
   a first diffraction grating (13);
   a second diffraction grating (14) provided on a face different from a face on which the first dif-

FIG.1
PRIOR ART

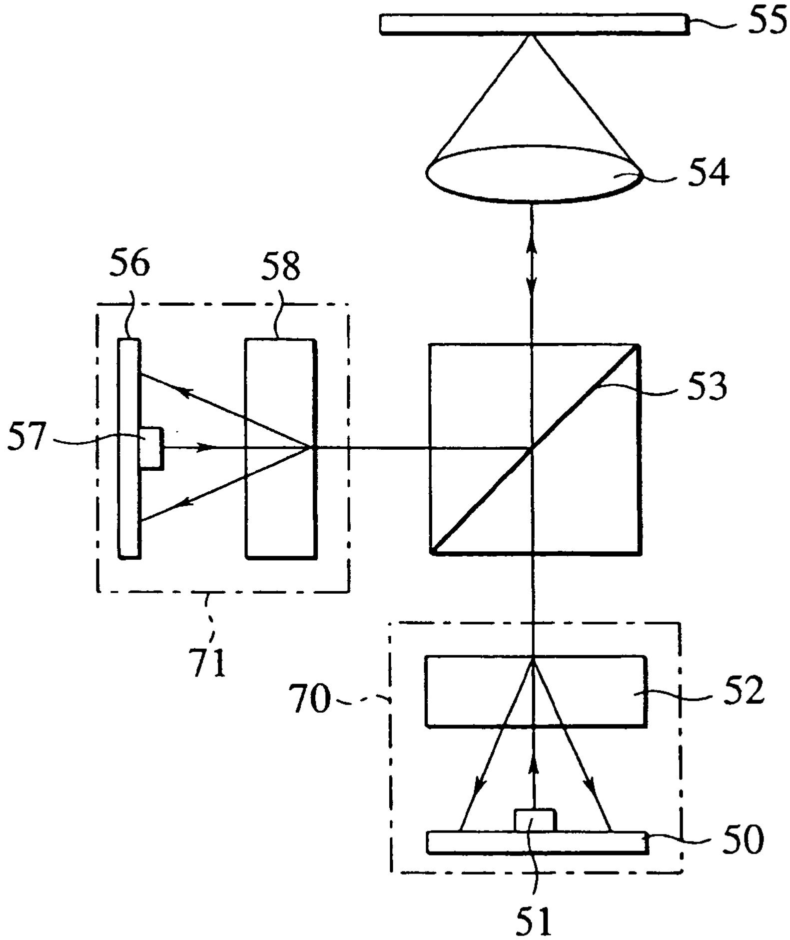


FIG.3

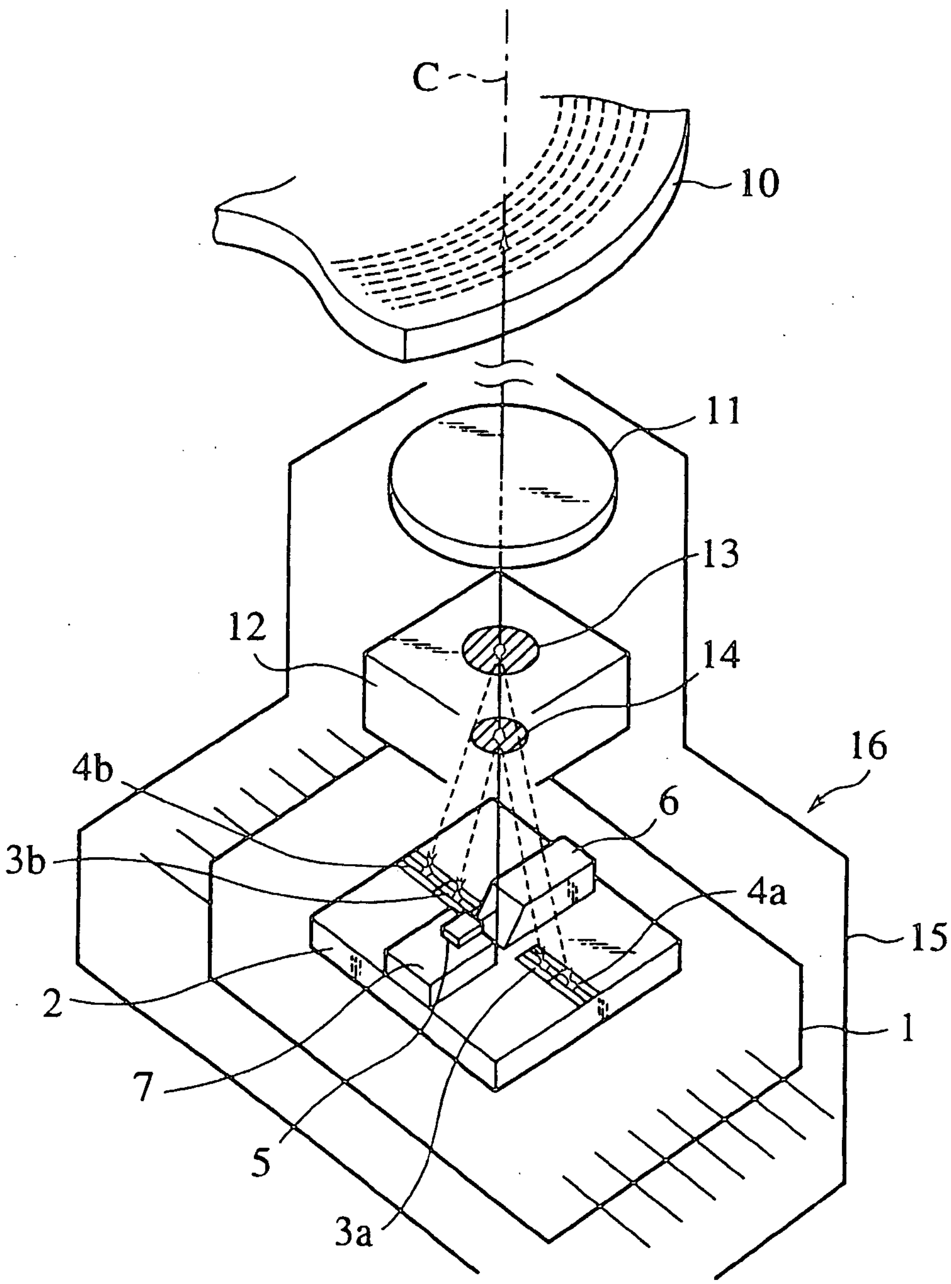
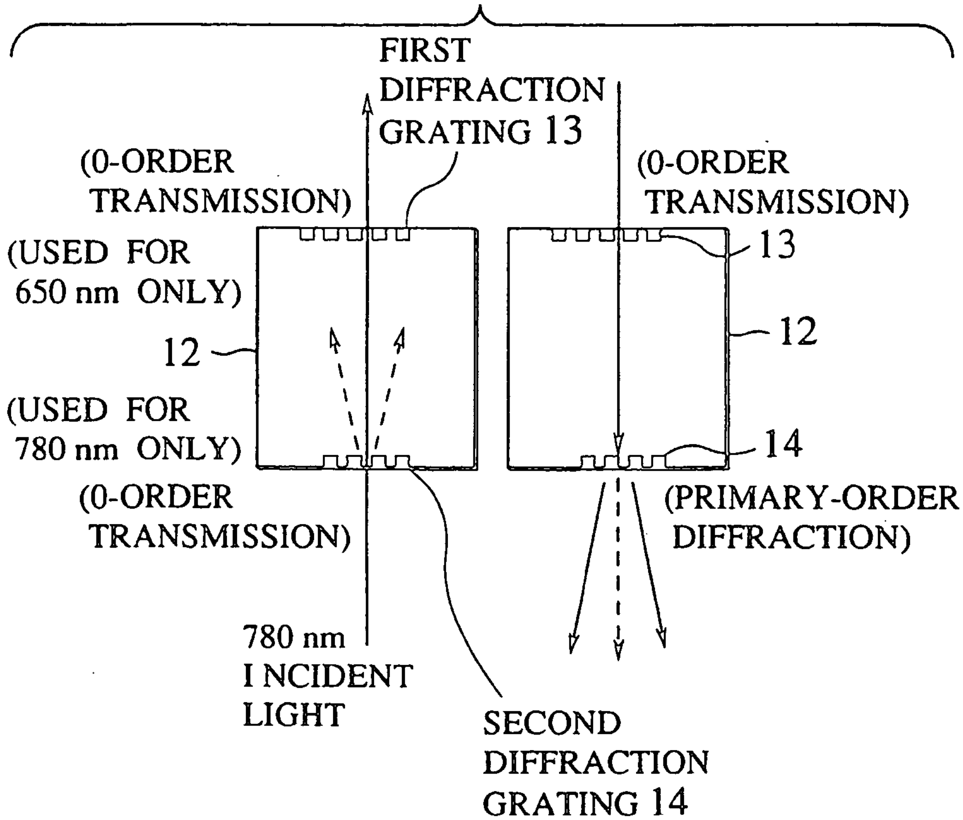


FIG.5A


FIRST
DIFFRACTION
GRATING 13
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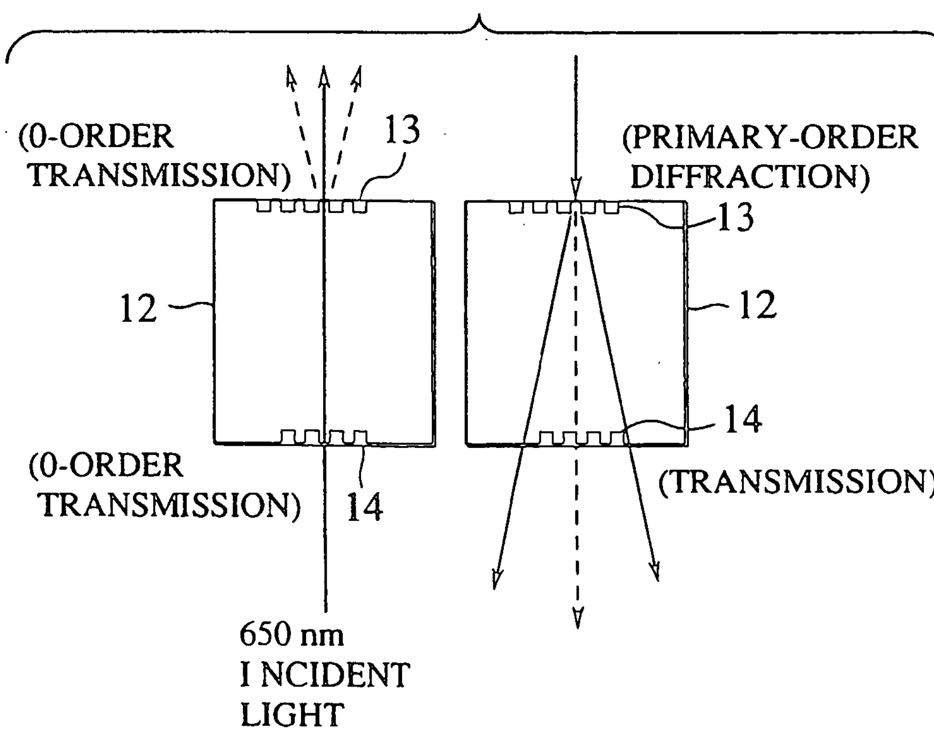
TRANSMISSION)
(0-ORDER
TRANSMISSION)
(USED FOR
650 nm ONLY)
13
12
12
(USED FOR
780 nm ONLY)
14
(0-ORDER
TRANSMISSION)
(PRIMARY-ORDER
DIFFRACTION)
780 nm
I NCIDENT
LIGHT
SECOND
DIFFRACTION
GRATING 14

FIG.5B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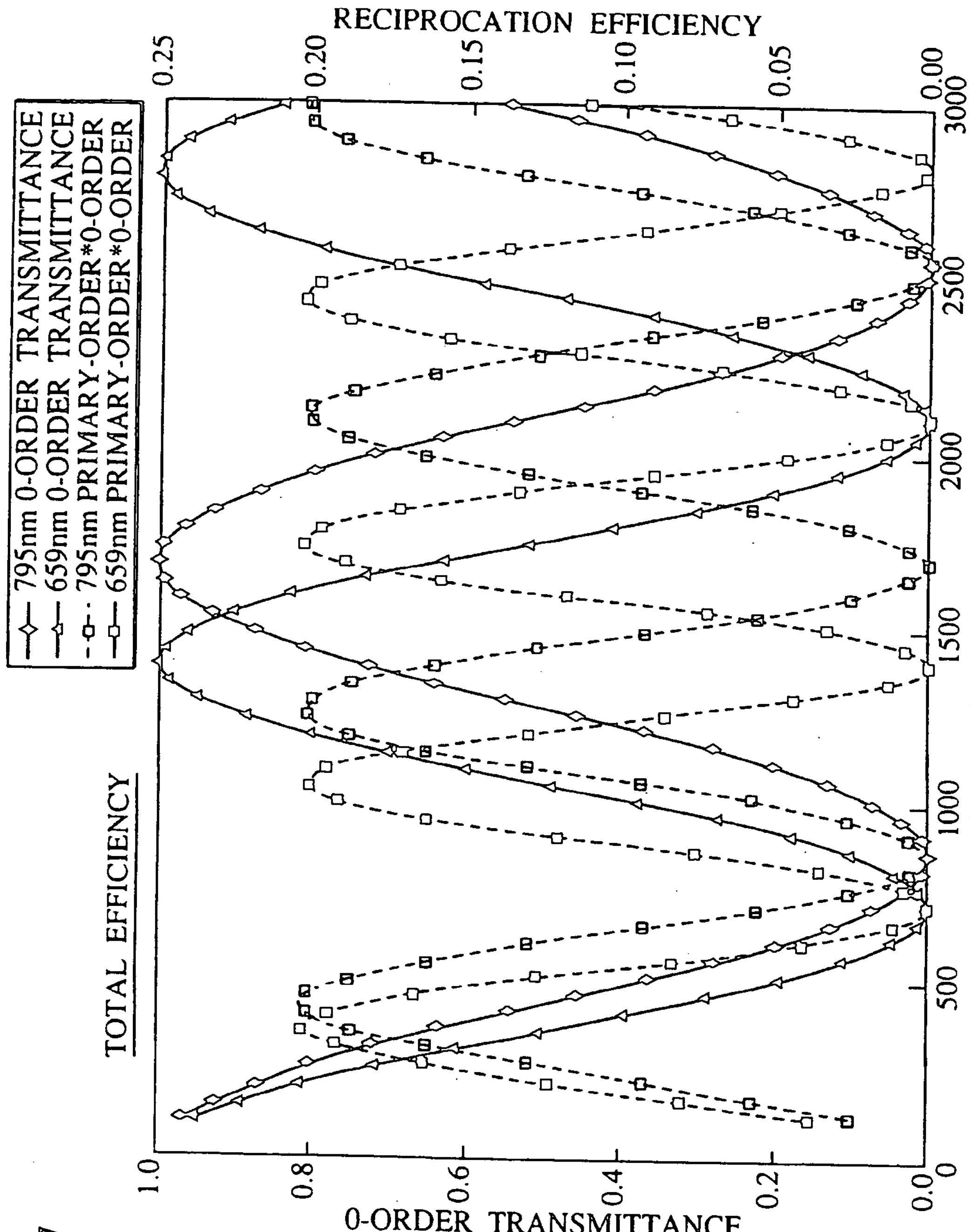
I NCIDENT
LIGHT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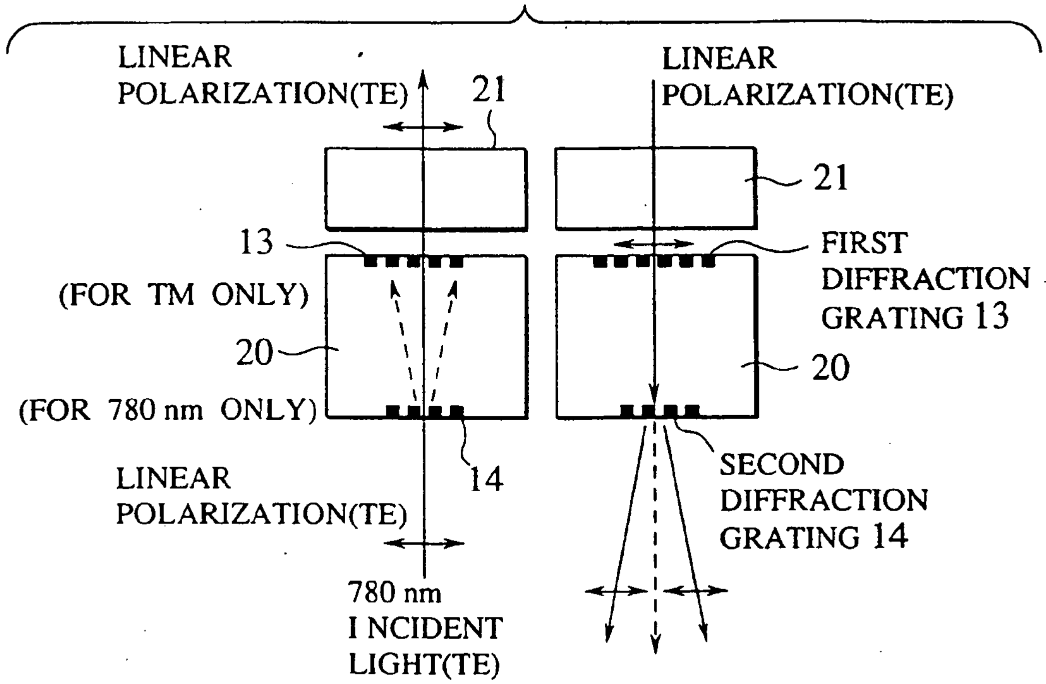
659nm 0-ORDER TRANSMITTANCE
795nm PRIMARY-ORDER*0-ORDER
659nm PRIMARY-ORDER*0-ORDER
TOTAL EFFICIENCY
1.0
0.8
0.6
0.4
0.2
0.0
0-ORDER TRANSMITTANCE
0
500
1000
1500
2000
2500
3000
GRATING DEPTH [nm]

FIG.7

FIG.9A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(FOR TM ONLY)
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(FOR 780 nm ONLY)
14
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POLARIZATION(TE)
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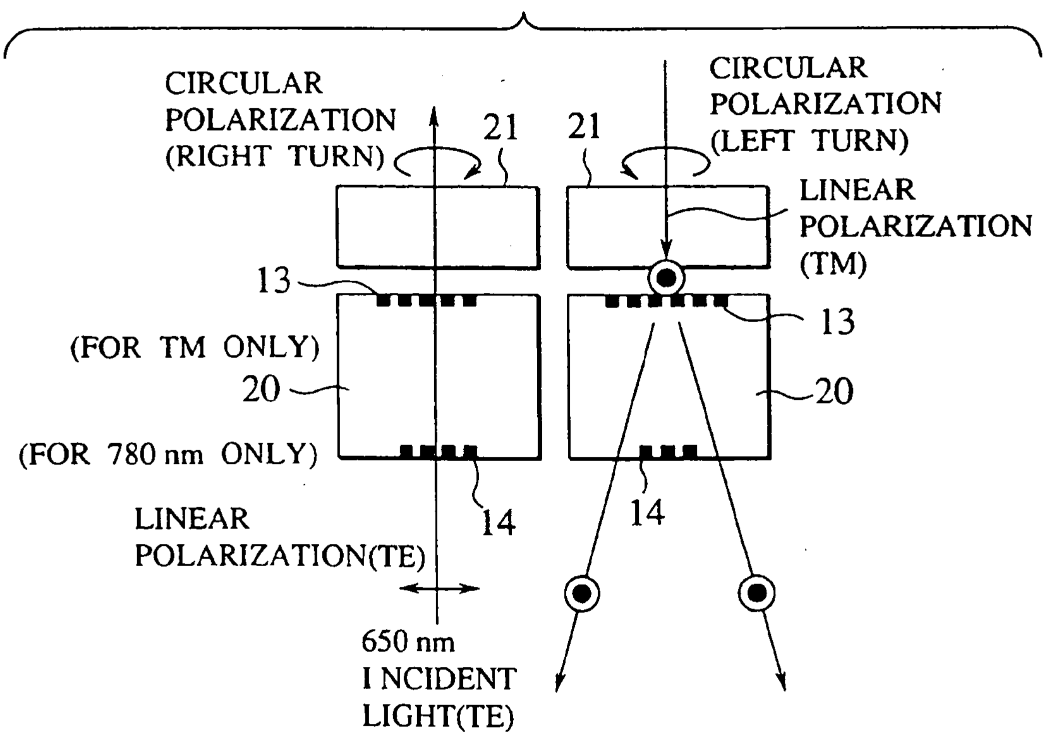
I NCIDENT
LIGHT(TE)
LINEAR
POLARIZATION(TE)
21
FIRST
DIFFRACTION
GRATING 13
20
SECOND
DIFFRACTION
GRATING 14

FIG.9B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13
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14

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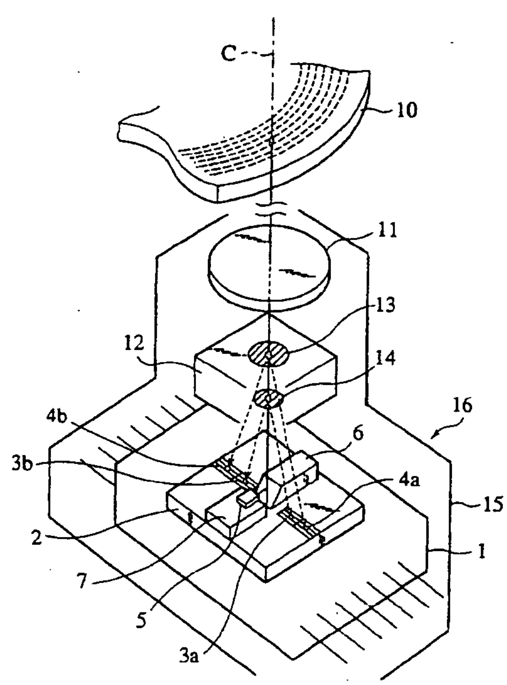
(54) Optical pickup and optical device

(57) An optical pickup of this invention includes a first laser beam source (8) having a wave length of 780 nm and a second laser beam source (9) having a second wave length of 650 nm wherein the first laser beam source (8) and the second laser beam source (9) are disposed in the vicinity of each other, emission lights from the first laser beam source (8) and the second laser beam source (9) are emitted along substantially the same optical axis and a reflected light from the information recording medium (10) is returned along the optical axis: the first diffraction grating (13), the second diffraction grating (14) and the light receiving device substrate (2) are disposed in order, the first diffraction grating (13) is substantially transparent for a wave length of 780 nm and diffracts a wave length of 650 nm, and the second diffraction grating (14) is substantially transparent for a wave length of 650 nm while it diffracts a wave length of 780 nm.

FIG.3



EP 1 001 413 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 12 0052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	YAMADA M ET AL: "DVD/CD/CD-R COMPATIBLE PICK-UP WITH TWO-WAVELENGTH TWO-BEAM LASER" IEEE TRANSACTIONS ON CONSUMER ELECTRONICS,IEEE INC. NEW YORK,US, vol. 44, no. 3, August 1998 (1998-08), pages 591-600, XP000851559 ISSN: 0098-3063 -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 June 2001	Holubov, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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